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DOI: https://doi.org/10.1515/jpm.2005.099

J. Perinat. Med. 33 (2005) 553–560 • Copyright © by Walter de Gruyter • Berlin • New York. DOI 10.1515/JPM.2005.099

Breast-feeding in women with hypertensive disorders in pregnancy

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Abstract

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Methods: Data on breast-feeding was collected within a nationwide research project on psychosocial factors in HDP. A self-administered questionnaire was given to 2600 women with a suspected history of HDP and 1233 controls. After matching and confirming diagnosis according to ISSHP criteria, 877 women with HDP and 623 controls were included into the study.
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Conclusions: Women affected by HDP breast fed significantly less often than control women. This effect is at least partly caused by the increased rate of prematurity. Encouraging and supporting these women in breast-feeding is important to improve neonatal physical and mental development.

Keywords: Breast feeding; HELLP syndrome; hypertensive diseases in pregnancy; pre-eclampsia; prematurity.

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Introduction

Hypertensive diseases in pregnancies (HDP) are one of the main reasons for maternal death in the USA and in Europe [16, 29] and responsible for about 15–20% of premature deliveries and perinatal death [30]. Despite intensive research, the etiology of HDP still remains unclear. A family history of HDP, increased pre-pregnancy body mass index, autoimmune diseases, multiple pregnancies, age, parity and ethnic background are known risk factors for the development of HDP, but allow only to identify part of the women at increased risk. As termination of pregnancy is still the only causal treatment available, many of the pregnancies complicated by HDP lead to a premature delivery of a child with known risk factors for physical and mental handicaps.

Complementary to the improvement in neonatal medicine, breast-feeding is another important option to improve the long-tem well being of these infants. Human milk is a complex biological fluid specific to our species, adapted to perfectly satisfy the nutritional and immunological needs of the child [31]. The milk produced by mothers of premature newborns during the first four weeks post partum is adapted to the special age-related needs of these children [31]. Consumption of human milk reduces the risk of necrotizing enterocolitis, atopy, gastrointestinal and respiratory infection [17, 24, 25, 36]. It is associated with fewer apnea episodes, fewer hospital days, and fewer days of oxygen therapy [12]. Likewise, the incidence of any infection, including sepsis and meningitis, is significantly lower among very low birth weight newborns that were fed with human milk than among those receiving exclusively artificial milk [2, 10, 18]. Breast milk supports the vulnerable premature infant by improving the gastrointestinal function and the absorption of nutrients [2, 10]. Breast-fed children and adolescents show significantly better scores in developmental tests and IQ tests than those receiving artificial milk, with a greater benefit found for low birth weight infants and for a longer duration of breastfeeding [1, 28]. These differences may either be due to the nutritional content of the breast milk and its direct impact on complex neural and cognitive functioning [21] or to the positive effect of breast-feeding on the mother-infant relationship, thereby indirectly supporting cognitive growth. Since most premature newborns receive milk by gavages it is evident that the improvement of the psychomotoric development is due to the milk itself and not only to the quality of mother care.

Risk factors of HDP such as obesity and chronic hypertension show a decreased incidence in breast fed infants [8]. Women with HDP have an increased risk to develop diabetes mellitus and coronary heart disease, both of which are also known to occur more often in patients fed by artificial milk [8]. Daughters of women developing HDP are at increased risk to develop HDP themselves [23].

To find out about breast-feeding rates after pregnancies complicated by HDP and to determine in which cases additional support could improve these rates; we investigated breast-feeding in a group of women with different forms of HDP.

Methods

Within the Hy-Di-Preg study (Hypertensive Disorders in Pregnancy), a research project across Germany initiated to investigate the role of epidemiological, psychosocial, psychosomatic and genetic factors in the etiology and course of HDP, we investigated breast-feeding behavior in women after having developed HDP. In cooperation with the German pre-eclampsia self-help group (Arbeitsgemeinschaft Gestose-Frauen e.V.), we designed a standardized self-administered questionnaire comprising epidemiological, obstetrical and psychosocial questions focused on the objectives of this study. Data were collected retrospectively. The questionnaire was sent to 2600 women that had addressed the German pre-eclampsia self-help group for information on HDP. One hundered and sixty-eight respondents had not presented HDP and 1067 women presenting at least one HDP returned a completed questionnaire.

One thousand and sixty-three control women were recruited in seven hospitals in Mid-West Germany after checking for exclusion criteria in the medical records. These were HDP, chronic hypertension, blood pressure $\geq$140/90 mmHg more than once during pregnancy, hypo- or hyperthyroidism, gestational diabetes, diabetes mellitus, autoimmune diseases and/or proteinuria $>$0.3 g/L in 24 h-urine or $\geq$1 g/L in spontaneous urine ($\cong \geq 1+$ on urine dipstick) during pregnancy. One hundred and sixty-two questionnaires from control women had to be excluded due to incomplete data. No statistically significant differences between control women participating, refusing to participate, or being excluded with regard to age, parity or socio-economic status, could be found. To ensure equal exclusion criteria for patients and controls, patients were also excluded from this analysis in case they presented hypo- or hyperthyroidism, gestational diabetes, and/or autoimmune diseases. Patients and control women were only included in the study if the complete data set on main outcomes and potential confounders was available. As mothers of preterm infants are more likely to be economically disadvantaged, unmarried, less educated and to smoke during pregnancy compared to mothers of full term infants [7, 14], we matched patients and controls for age, parity, educational level, and ethnic background. Patients in the first pregnancy complicated by HDP, which was carried beyond the 24th gestational week and controls in the first pregnancy carried beyond the 24th gestational week were considered for evaluation. All participants signed informed consent. Our institution's ethics committee approved the study.

All diagnoses of HDP were classified according to the criteria defined by the International Society for the Study of Hypertension in Pregnancy (ISSHP) [5]: Chronic hypertension (CH): Blood pressure $\geq$140/90 mmHg before 20 weeks of gestation and after six weeks post-partum, measured on two occasions, $\geq$6 h apart; Gestational hypertension (GH): Blood pressure $\geq$140/90 mmHg after 20 weeks of gestation and no longer than six weeks post partum, measured on two occasions $\geq$6 h apart; Pre-eclampsia (PE): GH/ CH + proteinuria [$>$0.3 g/L in a 24-h urine specimen or dipstick proteinuria score $\geq 1+$ in random urine collection]; HELLP syndrome (H): hemolysis (lactic dehydrogenase $\geq$3 SD), elevated liver enzymes (aspartate aminotransferase $\geq$3 SD, alanine aminotransferase $\geq$3 SD), platelet count $\leq$100 G/L]. After controlling each diagnosis by reviewing the patients' medical records, 891 patients were included in the study. As the group of women with chronic hypertension was rather small (N=14), these women were excluded, resulting in 877 patients and 623 controls.

Age was defined as the age at the beginning of each pregnancy. To evaluate the educational level, we differentiated between no final exam, extended primary school, high school, and secondary school. Classification was based on the final exam. Women smoking during the first trimester of pregnancy were classified as smokers. Women were asked whether they had had the wish to breast feed, whether they did breast feed, for how long they fed only maternal milk as well as whether and for how long they combined breast and bottle feeding. Breast-feeding behavior was controlled for gestational age as well as fetal weight at delivery, fetal sex and mode of delivery.

The Student *t*-test was used to compare group differences in continuous variables. Differences between proportions were analyzed by using the Chi-square test. Data analysis was performed with the statistical Package of the Social Sciences Advanced Statistics 4.0.

Results

Our results are based on 877 women with HDP and on 623 control women. In the patient group, 110 pregnancies were complicated by gestational hypertension, 364 by pre-eclampsia and 403 by HELLP syndrome. Sociodemographic data of both groups are presented in Table 1. As patients and controls were matched for age, parity, nationality and educational level, no significant differences were found. Marital status was similar in both groups. The number of multiple gestations did not vary significantly either. Control women smoked significantly more often during pregnancy in comparison to women with HDP (8.2/18.1%; $P<0.0001$).

Control women intended significantly more often to breast-feed compared to women developing gestational hypertension (86.8/66.4%; $P<0.0001$), pre-eclampsia (76.1%; $P<0.0001$) or HELLP syndrome (77.2%; $P<0.0001$). The intention to breast-feed did not vary significantly with the various types of HDP. Control women initiated (48.9/39.2%; $P<0.001$) and continued (42.2/37.2%; $P<0.005$) breast-feeding significantly more often compared to women developing HDP. While the per-

Table 1 Sociodemographic characteristics in patients and control women.

Variable	HDP (N = 877)	Control (N = 623)	P-value
Maternal age (years)	28.22 STD 4.1	29.2 STD 3.8	n.s.
Parity			
1	81.25%	84.37%	n.s.
>1	18.75%	15.63%	n.s.
Multiple gestations	1.4%	0.6%	n.s.
Caucasians (%)	99.9%	99.8%	n.s.
Educational status (%)			
<Secondary school	60.52%	60.08%	n.s.
Secondary school	39.48%	39.92%	n.s.
Marital status (%)			
Married/Cohabiting	98.3%	96.1%	n.s.
Smoking during pregnancy	8.19%	18.1%	<0.0001

centage of breast-feeding women with gestational hypertension or pre-eclampsia did not differ significantly from control women, women with HELLP syndrome initiated (48.9/34.7%; $P<0.0001$) and continued (42.2/33.5%; $P<0.0001$) breast-feeding significantly less often (Table 2). In comparison to women with pre-eclampsia, women with HELLP syndrome initiated breast-feeding significantly less often (42/34.7%; $P<0.05$), but no statistically significant difference could be found in the breast-feeding rate three months after delivery. In comparison with controls, the mean duration of breast-feeding of women with pre-eclampsia was significantly longer (8.9/7.7 months; $P<0.01$). No difference, however, became apparent in women with gestational hypertension or HELLP syndrome (Table 3). Table 4 shows perinatal data of women developing gestational hypertension, pre-eclampsia and HELLP syndrome in comparison to controls. Children of women developing any form of HDP are born significantly earlier and their birth weight is significantly lower compared to controls. The number of children delivered by cesarean section is significantly higher. In comparison to pre-eclampsia, children of women with HELLP syndrome are born significantly more often before the 32nd gestational week (28.3/38.7%; $P<0.005$) and less often after the 40th gestational week (7.6/3%; $P<0.01$). They are weighed at birth significantly more

Table 2 Distribution of breast-feeding in different types of HDP.

	GH#	PE#	HELLP#	Control	P value*
Number of women	N = 110	N = 364	N = 403	N = 623	
Intending to breastfeed	73 66.4%	277 76.1%	311 77.2%	541 86.8%	(a) <0.0001 (b) <0.0001 (c) <0.0001 (d) =0.0582 (e) n.s. (f) n.s.
Breast-feeding 1st month	51 46.4%	153 42%	140 34.7%	305 48.9%	(a) n.s. (b) <0.05 c) <0.0001 (d) <0.05 (e) n.s. (f) <0.05
Breast-feeding first 3 month	48 43.6%	143 39.9%	135 33.5%	263 42.4%	(a) n.s. (b) n.s. (c) <0.01 (d) =0.0676 (e) n.s. (f) n.s.

GH = Gestational hypertension, PE = Pre-eclampsia, HELLP = HELLP syndrome.

*(a) P-value for GH vs. control, (b) P-value for PE vs. control, (c) P-value for HELLP syndrome vs. control, (d) GH vs. HELLP syndrome, (e) GH vs. PE, (f) PE vs. HELLP syndrome.

Table 3 Mean duration of breast-feeding.

	GH#	PE#	HELLP#	Control	P value*
Number of women	N = 51	N = 153	N = 140	N = 305	
Mean	8.76	8.9	7.99	7.7	(a) = 0.0999
Range (month)	1–26	1–30	1–24	1–23	(b) < 0.01
SD	5.1	4.8	4.2	3.9	(c) n.s.

#only full and/or partly breast-feeding women were taken into account.
*(a) P-value for GH vs. control, (b) P-value for PE vs. control, (c) P-value for HELLP syndrome vs. control.

often below 1500 g (26.4/35.2%; P = 0.01). As was expected, a significantly higher number of children from mothers with HELLP syndrome were delivered by cesarean section (76.5/90.3%; P < 0.0001). In our study group, 65.6% of all children were born prematurely. Children born very prematurely (≤32: 19.5/81.8%; P < 0.0001) and children with a birth weight less than 1500 g (18.8/75%; P < 0.0001) were breast-fed significantly more often in the control group (Table 5). In the group of children born between the 32nd and 37th gestational week, the percentage of children being breast-fed was significantly higher in women whose pregnancy was complicated by HDP (53/30% P < 0.05%). Within the total group of children resulting from pregnancies complicated by HDP children were breast-fed significantly less often in case they were born before the 32nd gestational week compared to a term delivery (19.5/47.4%; P < 0.0001) and with less than 1500 g compared to normal weight infants (18.8/46.6%; P < 0.0001, Table 5).

The percentage of smoking women that breast-fed and the percentage of women that acted according to their intention to breast-feed did not vary between patients and controls. Fetal sex and the mode of delivery showed no correlation with breast-feeding (Table 5).

Discussion

The present breast-feeding rate reported from large German study groups is between 52 and 56% [22, 34]. The breast-feeding rate of 49% found in this study is in line with the current literature. In general, the breast-feeding initiation rates for preterm and low birth weight infants are lower than the respective rates for full term infants and vary considerably from 48% [13, 32] to 73% [13]. Both maternal and infant factors may uniquely affect the incidence of breast milk feeding in preterm infants. In comparison to full term infants, preterm infants are at greater medical risk and require prolonged hospitalization, both of which have an impact on the likelihood of breast milk feeding in this population. In HDP, especially in HELLP syndrome, due to which part of the women have to be treated in an intensive care unit, maternal complications may further adversely impact the initiation of breast-feeding. Hence, breast-feeding rate is lower after pregnancies complicated by HDP, especially when children are born prematurely.

However, breast-feeding is of particular importance for children born after HDP. The risk for HDP is increased in women whose mothers suffered from HDP [23]. This family risk factor on one hand is likely to be transmitted by genetic factors. On the other hand, family patterns of breast-feeding might be of influence as well. The long-term effects of breast-feeding include decreased incidences of obesity, hypertension, diabetes mellitus, atherosclerosis, and coronary heart disease in later life [8, 15, 35]. All these factors are correlated with HDP. Obesity and chronic hypertension are major risk factors of HDP and women developing HDP carry an increased risk to develop diabetes mellitus and coronary heart disease [4]. In our group of women presenting HDP, those with gestational hypertension and pre-eclampsia did not vary significantly in their breast-feeding rate when compared to controls. However, there was a large difference between women whose pregnancy was complicated by HELLP syndrome and controls. The exceptionally low breast-feeding rate in women after HELLP syndrome has several reasons. In our study group 43.5% (652/1500) of all children were born prematurely and 47.7% (311/652) had to be delivered early due to the HELLP syndrome. 77.1% of the women developing HELLP syndrome delivered before the end of the 37th and 38% before the end of the 32nd gestational week. As expected, most of these children were of low weight (Table 5).

In our study, premature infants that would most benefit from breast milk often received less mother milk in comparison to full-term infants, placing them at even higher risk [3, 20, 37]. Other investigators found no association between birth weight or gestational age and breast-feeding in very low birth weight infants [12, 38]. In contrast, very low birth weight infants in a large metropolitan US hospital were more likely to be breast fed if they were born at earlier gestational ages and weighed less at birth [13]. This difference is likely due to different support of mothers intending to breast feed their premature children. Only few mothers of children born prematurely are able to initiate and maintain an adequate milk production without qualified help and family support. The premature newborn shows physiological and neurological immaturity, muscle hypotony and hyperreactivity to environmental stimuli, and remains alert for only short periods of time [27]. However, despite its inadequate suction-deglutination-respiration control [19], a premature newborn is able to feed at the breast provided appropriate help is given

Table 4 Perinatal data in different types of HDP.

	GH#	PE#	HELLP#	Control	P value*
Number of women	N = 110	N = 364	N = 403	N = 623	
Gestational age at delivery					
≤32	13 11.9%	103 28.3%	156 38.7%	6 1%	(a) <0.0001 (b) <0.0001 (c) <0.0001 (d) <0.005 (e) <0.005 (f) <0.005
>32–≤37	29 26.2%	119 32.8%	155 38.4%	71 11.4%	(a) <0.0001 (b) <0.0001 (c) <0.0001 (d) <0.0001 (e) <0.05 (f) n.s.
>37–≤40	55 50%	114 31.2%	80 19.9%	365 58.6%	(a) <0.0001 (b) <0.0001 (c) <0.0001 (d) <0.0001 (e) <0.0005 (f) <0.0001
>40	13 11.9%	28 7.6%	12 3%	181 29%	(a) <0.005 (b) <0.0001 (c) <0.0001 (d) <0.0001 (e) n.s. (f) <0.01
Birth weight					
≤1500 g	15 13.3%	96 26.4%	142 35.2%	4 0.6%	(a) <0.0001 (b) <0.0001 (c) <0.0001 (d) <0.0001 (e) <0.01 (f) =0.01
>1500 g–≤2800 g	32 28.8%	166 45.5%	185 46%	78 12.5%	(a) <0.0001 (b) <0.0001 (c) <0.0001 (d) <0.005 (e) <0.05 (f) n.s.
>2800 g–≤3500 g	46 42.2%	68 18.6%	59 14.6%	310 49.8%	(a) n.s. (b) <0.0001 (c) <0.0001 (d) <0.0001 (e) <0.0001 (f) n.s.
>3500 g	17 15.7%	34 9.5%	17 4.2%	231 37.1%	(a) <0.0001 (b) <0.0001 (c) <0.0001 (d) <0.0001 (e) n.s. (f) <0.01
Mode of delivery					
Spontaneous	34 31.3%	68 18.8%	33 8.2%	386 62%	(a) <0.0001 (b) <0.0001 (c) <0.0001 (d) <0.0001 (e) <0.01 (f) <0.0001
Forceps/Vacuum	4 3.8%	17 4.8%	6 1.6%	71 11.4%	(a) <0.05 (b) <0.001 (c) <0.0001

(Table 4 continued)

	GH#	PE#	HELLP#	Control	P value*
					(d) n.s.
					(e) n.s.
					(f) <0.05
Cesarean section	72	279	364	166	(a) <0.0001
	65%	76.5%	90.3%	26.6%	(b) <0.0001
					(c) <0.0001
					(d) <0.0001
					(e) n.s.
					(f) <0.0001

GH = Gestational hypertension, PE = Pre-eclampsia, HELLP = HELLP syndrome.
*(a) P-value for GH vs. control, (b) P-value for PE vs. control, (c) P-value for HELLP vs. control, (d) GH vs. HELLP syndrome, (e) GH vs. PE, (f) PE vs. HELLP syndrome.

[9]. The fact that women delivering between the 32nd and 37th gestational week breast-fed significantly more often than control women reflects a generally high motivation for breast-feeding in women with HDP.

Difficulties in breast-feeding a premature child are very likely to be aggravated by maternal complications such as the need for intensive care or a prolonged maternal recovery from pre-eclampsia or HELLP syndrome. As the method of delivery shows no correlation with the breast-feeding rate (Table 5), these difficulties have to be attributed to the disease itself and not to a prolonged recovery resulting from cesarean section. In our study women with

Table 5 Initiation of breast-feeding in relation with smoking, intention to breastfeed and perinatal data.

	HDP	Control	P-value
Smoking during Pregnancy	(24/73) 46.6%	(46/113) 40.5%	(a) n.s.
Intention to Breastfeed	(327/634) 51.6%	(297/541) 54.9%	(a) n.s.
Gestational age at delivery			
$\leq$**32**	(54/277) 19.5%	(5/6) 81.8%	(a) <0.001
			(b) <0.0001
$>$**32–**$\leq$**37**	(162/306) 53%	(21/71) 30%	(a) <0.001
			(b) n.s.
$>$**37–**$\leq$**40**	(120/254) 47.4%	(176/365) 48.2%	(a) n.s.
			(b) Reference
$>$**40**	(24/54) 45.3%	(90/181) 49.6%	(a) n.s.
			(b) n.s.
Birth weight			
$\leq$1500 g	(49/258) 18.8%	(3/4) 75%	(a) <0.0001
			(b) <0.0001
$>$1500 g–$\leq$2800 g	(167/390) 42.9%	(47/78) 60%	(a) <0.0001
			(b) n.s.
$>$2800 g–$\leq$ 3500 g	(81/174) 46.6%	(153/310) 49.2%	(a) n.s.
			(b) Reference
$>$3500 g	(34/69) 49.4%	(108/231) 46.6%	(a) n.s.
			(b) n.s.
Fetal sex			
Female/all breast fed children		(182/377) 48.2%	
Mode of delivery			
Spontaneous	(65/138) 46.9%	(165/319) 51.4%	(a) n.s.
			(b) Reference
Forceps/Vacuum	(9/28) 32.3%	(36/71) 50.8%	(a) n.s.
			(b) n.s.
Cesarean section	(278/724) 38.4%	(72/166) 43.4%	(a) n.s.
			(b) = 0.0933

(a) P-value for comparison with control, (b) comparison with reference within the HDP group

HELLP syndrome initiated breast-feeding significantly less often than women developing pre-eclampsia or gestational hypertension. However, after three months following delivery, no statistically significant difference between women after gestational hypertension, pre-eclampsia and HELLP syndrome was found.

While it was more difficult for women after HELLP syndrome to start breast-feeding, the total duration of their breast-feeding was similar to the control group. This supports the hypothesis that it is difficult for these women to initiate breast-feeding, but once these difficulties have been overcome, a long period of successful breast-feeding will follow. It therefore seems mandatory to give these women proper support to initiate breast-feeding.

Women with HDP often develop feelings of guilt, especially when the pregnancy results in a premature delivery. In addition, the mother-infant relationship following premature birth is known to be weaker compared to infants born at term. The initial mother-infant separation, the infant's and/or mother's medical condition and uncertain survival, and the short pregnancy that interferes with the preparation for motherhood and familiarity with the individual child often disrupt the development of maternal behavior [11]. Oxytocin reduces depressions and anxiety, and lactating mothers were found to experience less stress compared to non-lactating mothers [6, 33]. Therefore, breast-feeding is likely to help creating a stable and fulfilling mother-child relationship.

The fact that women of the control group intended more often to breast-feed is likely to be influenced by the fact that, in some women, the diagnosis of HDP itself may have influenced the decision to breast-feed. As we performed a retrospective study, a bias especially on this question cannot be excluded. Hence, early interventions such as information on the importance of breast-feeding and the practical handling of pre-mature children may help to increase the motivation and confidence in the ability to breast-feed.

Women who smoke are less likely to breast-feed [14] and women who develop HDP are significantly more often non-smokers [26]. However, the rate of smoking and breast-feeding women was similar in patients and controls.

Several limitations apply to the results presented in this study. In unselected samples such as our control group, few infants with birth weights below 2500 g are included. Therefore, the significance of the perinatal status on breast-feeding in this group is limited. As data was collected retrospectively, it cannot be excluded that, especially the intention to breast-feed, is influenced by recall bias. Multiple gestations, a known risk factor for HDP, may also influence the intention and the continuation of breast-feeding. However, no statistically significant difference in the number of women with multiple gestations in both groups was found. The strength of this study is the large group of women presenting HDP that allows the comparison of breast-feeding rates in different forms of HDP as well as a meticulous verification of all diagnoses according to ISSHP criteria.

Conclusion

In comparison with control women, the number of women breast-feeding their children is significantly lower in HDP, especially in HELLP syndrome. This implies severe difficulties in breast-feeding when affected by these diseases. The problems have probably to be attributed to prematurity of the children born from pregnancies complicated by HPD, the prolonged recovery of the mothers and insufficient support from the obstetrical caregivers. The prolonged recovery is not due to an increased rate of cesarean section, but to the disease itself. In addition to known benefits resulting in a better short and long-term neonatal outcome for psychomotoric and cognitive development, breast-feeding of premature infants may benefit their mothers too. As they frequently experience feelings of guilt and anger, breast-feeding helps to cope with the early birth of their children. Also, with regards to adult diseases such as hypertension, diabetes mellitus, coronary heart disease and the increased risk for their offspring to develop HDP themselves, mothers affected by HDP should be encouraged and supported to breast-feed their children.

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Received May 1, 2005. Accepted July 17, 2005.